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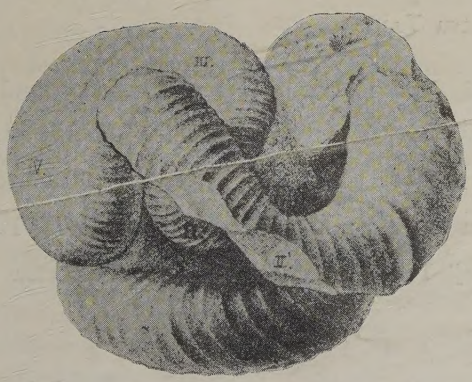

日本古生物學會

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CONTENTS

TRANSACTIONS

197. New Species and Genus of the Foraminifera of the Cenozoic Formations in the Middle Part of the Boso Peninsula, Chiba-ken. . . . . Takayasu UCHIO 33

198. Notes on the *Entomonotis*-bearing Triassic Formation at Iwai near Itsukaichi, Tokyo Prefecture, with a Description of a new *Entomonotis* . . . . . Koichiro ICHIKAWA 43

199. On the Myophorians from Kyoto Prefecture (Prov. Tango) . . . . . Nobukazu KAMBE 49

200. Pliocene Pinniped Remains from Kanazawa, Ishikawa Prefecture, Japan. . . . . Yoshio KASENO 57

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197. NEW SPECIES AND GENUS OF THE FORAMINIFERA OF THE CENOZOIC FORMATIONS IN THE MIDDLE PART OF THE BOSO PENINSULA, CHIBA-KEN, JAPAN*

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房總半島中部の新生代層産の有孔虫の新種及び新屬： 房總半島中部の大多喜・茂原地區及び君津郡湊町附近の新生代の諸地層から得た有孔虫の新屬及び新種を記載してある。大多喜地方産のものについては且つて石油技術協會誌第15巻, 第4號に一部記載（和文）したが, ここに再び詳細に記載してある。

大多喜・茂原地區よりは *Pseudoeponides japonicus, Cassidulina asanoi, C. nakamurai, Entosolenia marginata* var. *semistriata*（以上は再記載), *E. ozawai* sp. nov., *E. circulo-costa* var. *carinata* nov., *Heronallenia otukai* sp. nov. を記載し, 湊町附近からは *Pyrgo depressa* var. *tomiyensis* nov., *Cassidulina tomiyensis* sp. nov., *Bolivina otukai* sp. nov., *Loxostomun koikei* sp. nov., *Entosolenia marginata* var. *cushmani* sp. nov., *E. marginata* var. *angulata* nov., *Vagocibicides nipponicus* sp. nov. を記載してある。 内尾高保

The new species and genus described in this paper are sampled from two districts of the middle part of the Bōsō Peninsula, Chiba-ken. Geology and palaeontology in Ōtaki Gas Field were already published in Japanese in the previous paper,[1] in which the writer briefly described foraminiferal assemblages and new species and genus. Thereafter the manuscript[3] describing detail zonules and sampling method of the foraminifera is submitted to the Geological Society of Japan to be printed in the near future. The present paper describes the new species and genus in detail to determine *Pseudoeponides japonicus* gen. et sp. nov., *Heronallenia otukai* sp. nov., *Cassidulina asanoi* sp. nov., *C. nakamurai* sp. nov., *Entosolenia marginata* var. *semistriata* nov., *E. ozawai* sp. nov. and *E. cirulocosta* var. *carinata* nov.

The writer has also described new species of foraminifera from the Cenozoic Formations at Minato-machi[2] in the western part of the middle Bōsō Peninsula, near Tōkyō Bay. The manuscript of the foraminiferal assemblage of each formation of this district was read at the monthly meeting of the Geological Society of Japan held on 21th Oct. 1950 to describe the following new species: *Pyrgo depressa* var. *tomiyensis* nov., *Bolivina otukai* sp. nov., *Loxostomum koikei* sp. nov., *Entosolenia marginata* var. *cushmani* nov., *E. marginata* var. *angulata* nov., *Cassidulina tomiyensis* sp. nov., *Vagocibicides nipponicus* sp. nov.

All the registered type specimens of these new species are deposited in the Geological Institute, Faculty of Science, University of Tōkyō.

The writer wishes to express his cordial thanks to Prof. K. Uwatoko, the late Prof. Y. Ōtuka and Dr. Leo. W. Stach for their kind advices in field

* Read Dec. 2nd, 1950; received Nov. 6th, 1950

and laboratory works. This short paper is dedicated to late Dr. Yanosuke ŌTUKA, Professor of Structural Geology, Geological Institute of Tōkyo University.

Stratigraphical sequences in these districts are shown in the following Table in descending order:

(Ōtaki-Mobara district)

Kasamori Formation Mandano Formation		Pleistocene
Chōnan Formation Kakinokidai Formation		Plio-Pleistocene
Kokumoto Formation Umegase Formation Ōtadai Formation Kiwada Formation		upper Pliocene

(Minato-machi district)

Sanuki	siltstone	Pleistocene
Nagahama	sand & gravel	
..... unconformity		
Iwasaka	fine sandstone	upper Pliocene
Komaba	tuff-breccia	
Tomiya	tuffaceous sandstone	
Hagiu	pyroclastics	lower Pliocene
Inagozawa	mudstone	
Senhata	conglomerate	
..... unconformity		
Amatsu	mudstone	upper Miocene

Sanuki siltstone and Nagahama sand and gravel are quite the same with Kasamori Formation and Mandano Formation in Ōtaki-Mobara district respectively. Tomiya tuffaceous sandstone may be correlated with Mimata shell bed of Kiwada Formation by foraminiferal assemblage.

Description of New Species

Family Miliolidae

Genus *Pyrgo* DEFRANCE, 1842

Genotype *Pyrgo laevis* DEFRANCE

Pyrgo depressa var. *tomiyensis* UCHIO, var. nov.

Plate. 3, Figures. 9 a, b.

Description:—Test in front view nearly circular, compressed, toward the periphery extending out into a thin carina, in end view ellipsoid, the edge angled and drawn out into the carina; ventral chamber is very small, about 2/5 times as large as dorsal chamber, not circular; wall smooth, dull white; aperture broad, without a neck, the tooth on ventral side wide, extending nearly the whole width of the aperture, and in end view nearly filling the opening, leaving the actual aperture but a narrow slit-like opening.

Holotype:—Reg. No. CF 3014 in tuffaceous coarse sandstone at Loc. 11, type-locality of Tomiya tuffaceous sandstone (Tomiya, Takeoka-mura, Kimitsu-gun, Chiba-ken), 100 m. SWW of Kazusaminato Railway-station on West Bōsō Line (upper part of Tomiya tufaceous sandstone, upper Pliocene) Length ca. 0.68 mm. thickness ca. 0.41 mm.

Comparision:—Variety differing from typical one by having always much smaller ventral chamber than dorsal chamber; variety also easily distinguishable from *P. depressa* var. *murrhyna* by having much smaller ventral chamber and no neck.

Occurrence and geological age:—Not rare, only known from type-locality above mentioned, upper Pliocene.

Family Buliminidae

Genus *Bolivina* D'ORBIGNY, 1839

Genotype: *Bolivina plicata* D'ORBIGNY

Bolivina otukai UCHIO, sp. nov.

Plate. 3, Figures. 7 a, b.

Description:—Test compressed, more or less broader than long, broadest at the middle part of the test, somewhat triangular-shaped; chambers numerous, narrow; sutures distinct, much limbated, curved; wall finely perforate; aperture elongate, narrow.

Holotype:—Reg. No. CF 3012 in fine sandstone just above tuff at Loc. 6A, type-locality of Iwasaka fine sandstone along sea-cliff, about 500 m. north of Kazusa-minato Railway-station on West Bōsō Line (middle part of Iwasaka fine sandstone, upper Pliocene). Length ca. 0.23 mm, width ca. 0.29 mm.

Comparision:—This new form is easily distinguishable from any other species of the genus by having much limbated sutures, periphery and broader test.

Occurrence and geological age:—Only one specimen at type-locality above mentioned, upper Pliocene.

Remark:—The specific name is dedicated to late Dr. Yanosuke ŌTUKA, Professor of Geological Institute of Tōkyō University.

Genus *Loxostomum* EHRENBERG, 1854

Genotype: *Loxostomum subrostratum* EHRENBERG

Loxostomum koikei UCHIO, sp. nov.

Plate 3, Figures 6 a–c.

Description:—Test compressed, elongate, broadest in the middle part of the test, apical end truncated, distal end rounded; chambers distinct, numerous, becoming larger as added; suturs distinct, much limbated; periphery somewhat tricarinated particularly on lower half, namely, a slightly projected median keel between angled margins of both sides; aperture terminal, fissurine or very narrow, elongate, entosolenian.

Holotype:—Reg. No. CF 3013 in tufaceous coarse sandstone at Loc. 11, type-locality of Tomiya tufaceous sandstone (Tomiya, Takeokamura, Kimitsu-gun, Chiba-ken), 1000 m. SWW of Kazusa-minato Railway station on West Bōsō Line (upper part of Tomiya tufaceous sandstone, upper Pliocene). Length ca. 0.55 mm, width ca. 0.30 mm.

Comparision:—This new form is easily distinguishable from any other species of the genus by having much limbated sutures and somewhat tricarinated periphery.

Occurrence and geological age:—Only one specimen at type-locality above mentioned, upper Pliocene.

Remark:—The specific name is dedicated to Mr. Kiyoshi KOIKE who made geological survey of this district.

Genus *Entosolenia* EHRENBERG, 1848

Genotype: *Entosolenia lineata* WILLIAMSON

In view of the recent progresses of Japanese Cenozoic Stratigraphy by microfossils, especially by Foraminifera, strict identification of species is demanded. For this purpose the writer has made palaeontologically foundamental research of the genus *Entosolenia*. A study of the various collections of foraminifera now stored in the Institute of Petroleum Engineering, Tōkyō University, Japan, has rendered the writer possible to review the Japanese species of *Entosolenia*, both fossils and recent. Japanese Foraminiferists have adopted the clas-

sification by J. A. CUSHMAN except about Nodisariidae, GALLOWAY's classification of which is adopted generally. According to GALLOWAY, *Oolina* d'ORBIGNY, 1839; *Fissurina* REUSS, 1850 and *Obliquina* SEGUENZA, 1862 are valid, while CUSHMAN adopted *Entosolenia* EHRENBERG, 1848 for these genera. These genera belong to the Family Nodosariidae and Buliminidae according to GALLOWAY and CUSHMAN respectively.

The description of the genus *Oolina* d'ORBIGNY, 1839 is "Test free, monothalamous, ovate, round in cross section; wall hyaline, very finely perforated, smooth, costae or otherwise ornamented without or with apical spine or spines; aperture entosolenian, rounded, simple, sometimes with radiating grooves or ridge around the external part of the aperture"; compressed forms otherwise like *Oolina* belong to *Fissurina* REUSS, 1855 and excentric forms otherwise like *Oolina* belong to *Obliquina* SEGUENZA 1862. These three genera have monothalamous test and entosolenian aperture, and this is why CUSHMAN adopted *Entosolenia* EHRENBERG 1848. The difference among *Oolina*, *Fissurina* and *Obliquina* is very scarce and in the specific category, therefore the writer has adopted CUSHMAN's classification. As many authors have confused, it is difficult to discriminate strictly these genera and *Lagena* WALKER et JACOB, 1798. Most species of *Lagena* of many authors may belong to *Entosolenia*. Of many different species of *Entosolenia* hitherto distinguished from writer's collection the following species are valid, namely

Entosolenia marginata (WALKER et BOYS)
E. marginata var. *cushmani* UCHIO, nov.
E. marginata var. *angulata* UCHIO, nov.
E. marginata var. *semistriata* UCHIO
E. circulo-costa (ASANO)
E. circula-costa var. *carinata* UCHIO, nov.
E. orbignyana (SEGUFNZA)
E. orbignyana var. *lacunata* (BURROWS et HOLLAND)
E. orbignyana var. *clathrata* (BRADY)
E. orbignyana var. *coronata* (SIDEBOTTOM)
E. orbignyana staphyllearea (SCHWAGER)
E. laevigata (REUSS)
E. globosa (MONTAGU)
E. ozawai UCHIO, sp. nov.

Besides these species CUSHMAN and BRADY reported following recent species near Japan, that is,

E. orbignyana var. *crenulata* (CUSHMAN)
E. orbignyana var. *alata* (CUSHMAN)

Entosolenia marginata var. *semistriata* UCHIO

Plate 3, Figures 12 a, b.

Entosolenia semistriata UCHIO, *Jour. Assoc. Petrol. Tech., 1950, vol. 15. No. 4*, P. 190, Fig. 15. (in Japanese)

Description:—Test circular or slightly ovate, quite similar to that of *E. marginata* (WALKER & BOYS), but differing from typical one by having several fine costae and sometimes also fine pits on the lower half of the test; aperture fissurine, entosolenian.

Holotype:—Reg. No. OF 3005, in mudstone beneath 015 B Tuff at LocII-119 B about 1600m. southeast of Shōryūji, Nakagawa-mura, Isumi-gun, Chiba-ken. Length ca. 0.20 mm. Width ca. 0.18 mm. Thickness ca. 0.13 mm.

Occurrence and geological age:—Rare in "Ōtadai," "Umegase", and "Kokumoto" Formation, all upper Pliocene formation of Bōsō Peninsula.

Entosolenia ozawai Uchio, sp nov.

Plate 3, Figures 10 a, b.

Description:—Test cylindrical, tapering to apical end, round in apertaral view, truncate and flat or concave at initial end, broadest in middle part of the test, surface ornamented with many long spiral costae; running from initial to apical end; apertare rounded, entosolenian.

Holotype:—Reg, No. CF 3006, in sandy mudstone at Loc. II-215, Odoro, Kamitakimura, Isumi-gun, Chiba-ken along Ōtaki-Chōnan High-Way. Length ca. 0.18 mm, width ca. 0.12 mm. (Upper part of Umegase Formation, Upper Pliocene)

Occurrence:—Only one specimen at type locality above mentioned.

Remark:—The specific name is dedicated to late Dr. Yoshiaki Ozawa.

Entosolenia circulo-costa var. *carinata* Uchio, var. nov.

Plate 3, Figures 11 a, b.

Description:—Variety with much compressed test, surrounded by a wide thin carina; wall ornamented with two prominent circular raised rims about the body proper: aperture fissurine, entosolenian.

Holotype:—Reg. No. CF 3007 in sandy mudstone just above C_3 Tuff at Loc. 34, Hōonji, Nishi-mura, Chōsei-gun Chiba-ken (lower part of Chōnan Formation, Pleistocene). Length ca. 0.23 mm, width ca. 0.17 mm, thickness ca. 0.14 mm.

Text-figs
Entosolenia cioculo-costa
(Asano)
Copy of the original figures

Comparision:—Variety differing from typical form by having a wide thin carina and far more prominent circular rims than those of the latter, therefore in apertural view, the former resembles *E. orbignyana* and the latter *E. marginata*. Variety also easily distinguishable from typical one by having smaller test, general outline of the test and apertural character.

Occurrence:—Fairly abundant at type-locality above mentioned.

Entosolenia marginata var. *cushmani* Uchio, var. nov.

Plate 3, Figures 13 a, b.

Lagena marginata var. Cushman, 1933, *U. S. Nat. Mus., Bull. 161*, Pl. 4, Figs 14a, b, P. 17

This new variety is formerly reported as *E. marginata* by many authors, but J. A. Cushman always described this as *E. marginata* var. Variety quite resembles the typical *E. marginata* (Walker & Boys) except the former having an opaque band around the inner margin of the test.

Holotype:—Reg. No. CF. 3009, in tufaceous coarse sandstone at Loc. 11,

type locality of Tomiya tufaceous sandstone (Tomiya, Takeoka-mura, Kimitsu-gun, Chiba-ken), 1000 m SWW of Kazusaminato Railway-station of West Bōsō Line, (upper part of Tomiya tuffaceous sandstone, middle Pliocene). Length ca. 0.32 mm, width ca. 0.30 mm.

Occurrence and geological age:—Not rare at type-locality above mentioned also found out throughout upper Pliocene and Plio-Pleistocene Formations of Bōsō Peninsula, Chiba-ken.

Remark:—The specific name is dedicated to Dr. J. A. CUSHMAN.

Entosolenia marginata var. *angulata* UCHIO, var. nov.

Plate 3, Figures 14 a, b.

Lagena marginata var. CUSHMAN, 1933, *U. S. Nat. Mus., Bull. 161*, Pl. 4. Figs. 11 a, b. P. 17

This new variety is also formerly described as *E. marginata* by many authors, but J. A. CUSHMAN always described this as *E. marginata* (W. & B) var. Variety quite resembles *E. marginata* and *E. marginata* var. *cushmani*, but the periphery of this is exceedingly thickened. Therefore apertaral view of this variety is elongate quadrangular. Variety also easily distinguishable by having neither an opaque band nor thin carina.

Holotype:—Reg. NO. CF. 3010 in tufaceous coarse sand-stone at Loc. 11, type-locality of Tomiya tufaceous sandstone (Tomiya, Takeoka-mura, Kimitsu-gun, Chiba-ken), 1000 m SWW of Kazusaminato Railway-station of West Bōsō Line (upper part of Tomiya tafaceous sandstone, upper Pliocene). Length ca. 0.31 mm, width ca. 0.28 mm.

Occnrrence and geological age:—Not rare at type-locality above mentioned, also found out throughout upper Pliocene and Plio-Pleistocene Formations of Bōsō Peninsula, Chiba-ken.

Family Rotaliidae

Genus *Pseudoeponides* UCHIO, 1950

Genotype, *Pseudoeponides japonicus* UCHIO

Test trochoid, biconvex, umbilical area closed: wall calcareous, finely perforate: chambers numerous, all visible from the dorsal side, only those of the last-formed whorl visible from the ventral side: aperture a low opening between the periphery and umbilical area, usually well away from the peripheral margin, with supplementary apertures loop-shaped opening along each suture radiating from the umbilicus ventrally and also elongate slit in each chamber parallel to each suture dorsally.

This new genus is closely allied to *Mississippina* HOWE, 1930 in respect of aperture and supplementary apertures but the aperture of the latter extending to the periphery, that of the former well away from the periphery, moreover the dorsal supplementary apertures of the latter elongate slits near the periphery, those of the former loop-shaped, radiating from umbilicus. This new genus also quite resembles *Eponides* MONTFORT, 1808 respecting outline of the test, but the latter has no supplementery apertures. Judging from the structure of the test and aperture, this new genus may derive from *Epistomina* TERQUEM, 1883.

Pseudoeponides japonicus UCHIO

Plate 3, Figures 1 a-c

Pseudoeponides japonica UCHIO; *Journ. Assoc. Petro. Tech. Vol. 15, No. 4*, 1950, P. 190, Fig. 16 (in Japanese).

Description:—Test trochid, biconvex,

close-coiled, peripheral margin rounded, sutures depressed on both sides, strongly oblique to spiral suture dorsally, shape of chamber nearly triangular; aperture a low opening between the periphery and umbilical area, well away from the peripheral margin, with snpplementary apertures loop-shaped opening along suture radiating from umbilicus ventrally and also elongate slit in each chamber parallel to each suture dorsally.

Holotype:—Reg. No. CF 3002 in sandy mudstone beneath Ka_1 Tuff, along Ōtaki-Chōnan High Way, beside the bridge, 200 metres southeast of Primary Scholl, Satsubo, Nishi-mura, Chōsei-gun, Chiba-ken Japan. Length ca. 0.30 mm, thickness ca. 0.17 mm (Kakinokidai Formation, Plio-Pleistocene)

Associated faunule:—Except Globigerinidae, *Gaudryina* cf. *ishikiensis* ASANO very abundant, *Cassidulina subglobosa* BRADY, *Bulimina aculeata* D'ORBIGNY and *Pseudoeponides japonicus* are also common.

Occurrence:—In Bōsō Peninsula, Chiba Pref, this new species is hitherto found in Kokumoto Formation (upper Pliocene) Kakinokidai Formation (Plio-Pleistocene) and Sanuki Formation (Plio-Pleistocene).

Remark:—After the writer described Mr. Y. KUWANO also described this species under the name "*Epistomaria* (*Epistomariella*) *miurensis* n. subgen. et n. sp." in article entitled "Foraminifera from the Pliocene Formations of Tama Hills", *Jour. Geol. Soc. Japan, vol. 56, No. 657*, 1950.

Genus *Heronallenia* CHAPMAN & PARR, 1931

Genotype, *Discorbina wilsoni* HERON-ALLEN et EARLAND

Heronallenia otukai UCHIO, sp nov.

Plate 3, Figures 5 a, b.

Description:—Test much compressed, ovate, superior surface slightly convex, inferior concave; periphery rounded; sutures and margin on superior surface limbate; chambers comparatively few, about 4–6 in last whorl, enlarging rapidly, slightly inflated; whorl 1.5; aperture a strongly arched slit situated in a depression on the inferior surface of the last chamber, and is visible as small round beads along each septal suture on the superior surface; shell very finely polished, many radially depressed striation on the inferior surface.

Holotype:—Reg. No, CF 3008, in mudstone beneath O_2 Tuff Loc. I-476, Nakano, Kamitaki-mura, Isumi-gun, Chiba-ken (Lower part of Umegase Formation, upper Pliocene). Length ca. 0.37 mm width ca. 0.29 mm.

Comparision:—This new form resembles *H.* (?) *lingulata* (BURROWS & HOLLAND) shown in BRADY's Challenger Report (Pl. XCI, Fig 3, not 2, p. 653, under the specific name "*Discorbina biconcava* PARKER & JONES") in its superior surface but is quite different in interior surface.

Occurrence and geological age:—Rare in "Umegase" and "Kokumoto" Formations both upper Pliocene.

Remark:—The specific name is dedicated to late Dr. Yanosuke OTUKA, Professor of Geological Institute of Tōkyō University.

Family Cassidulinidae

Genus *Cassidulina* D'ORBIGNY, 1826

Genotype: *Cassidulina laevigata* D'ORBIGNY, *Ann. Sci. Nat., Vol. 7, 1826*, p. 292, Pl. 15, Figs. 4. 5, model No. 41: recent sand from ship's ballast.

Cassidulina asanoi UCHIO

Plate 3, Figures 2 a, b.

Cassidulina asanoi UCHIO, *Jour. Assoc. Petrol. Tech., 1950, Vol. 15, No. 4,* P. 190, Fig. 13 (in Japanese)

Description:—Test compressed, nearly circular in side view, lenticular in edge view; chambers distinct, elongate, 4 pairs in last-formed coil; sutures distinct, depressed, much curved; wall smooth, hyaline, transparent: periphery angled with thin carina; aperture a very long slit along suture of last chamber. Diameter ca. 0.29 mm, thichness ca. 0.10 mm.

Holotype:—Reg. No. CF 3003, in sandy mudstone beneath Ku_{5B} Tuff at Loc. 753, Ōyagi, Tsuchimutsu-mura, Chōsei-gun, Chiba-ken (Lower part of Kokumoto Formation, upper Pliocene).

Comparision:—This species formerly determined as *C. laevigata* D'ORBIGNY by K. ASANO. The writer obtained many specimens of this new form from type locality but non of them resemble D'ORBIGNY's original figure which is the schematic model figure of specimen from ship's ballast, the source of which is unknown. K. ASANO figured two types of *C. laevigata* (?), namely Text-figs. 11 a, b, and Plate XII, Figs. 4 a, b in his paper entitled "On the Japanese Species of *Cassidutina, Japan. Jour. Geol. Geogr. Vol. XIV, Nos. 2-3,* 1937" but they are different from one another and the latter is the writer's new from.

Occurrence and geological age:—Abundant at type locality above mentioned and fairly common in Upper Pliocene formation of Bōsō Peninsula.

Remark:—The specific name is dedicated to Dr. Kiyoshi ASANO, Assistant Professor of Tōhoku University, Sendai.

Cassidulina nakamurai UCHIO

Plate 3, Figures 4 a, b.

Cassidulina nakamurai UCHIO, *Jour. Assoc. Petrol. Tech., 1950, Vol. 15, No. 4,* P. 190, Fig. 14. (in Japanese)

Description:—Test compressed, nearly circular in side view, lenticular in edge view, periphery angled with thin carina; chambers distinct, short, triangular, 4 pairs in last-formed coil, sutures distinct, neary straight slightly depressed; wall smooth, hyaline, transparent, particularly in umbonal region where earlier chambers and proloculus are visible; aperture elongate, nearly parallel to axis of coiling.

Holotype:—Reg. No. CF 3004 from sandy mudstone at Loc. II-218, southern entrance of Odoro Tunnel, Kamitaki-mura, Isumi-gun, Chiba-ken (Uppermost part of Umegase Formation, upper Pliocene) Diameter ca. 0.31 mm., thichness ca. 0.10 mm.

Comparision:—This new form is closely allied to *C. yabei* ASANO & NAKAMURA, but the chambers of the former short, nearly triangular, 4 pairs in last coil, those of the latter elongate, somewhat quadrangular, 5-6 pairs in last coil; aperture of the former is shorter than that of the latter.

Occurrence and geological age:—Fairly common at type-locality above mentioned, also found throught out upper Pliocene and Pleistocene Formationsof Bōsō Peninsula.

Remark:—The specific name is dedicated to Mr. Masayoshi NAKAMURA.

Cassidulina tomiyensis UCHIO, sp nov.

Plate 3, Figures 3 a, b.

Description:—Test somewhat compressed, ovate in side view; chambers distinct, 6 pairs in last coil, much inflated but suddenly depressed near margin.

Comparision:—This new form resembles *C. orientele* in its out-line of the test and aperture, but the former has much inflated chambers which are de-

pressed suddenly near margin showing peculiar edge view.

Holotype:—Reg. No. CF 3011 in tufaceous coarse sandstone at Loc. 11, type-locality of Tomiya tufaceous sandstone (Tomiya, Takeoka-mura, Kimitsu-gun, Chiba-ken), 1000 m SWW of Kazusaminato Railway-station of West Bōsō Line (Upper part of Tomiya tufaceous sandstone upper Pliocene). Length ca. 0.46 mm, width ca. 0.37 mm, thickness ca. 0.2702 mm.

Occurrence and geological age:—Not rare at type-locality above mentioned, but rare in "Sanuki" and "Kasamori" Formations.

Family Anomalinidae

Genas *Vagocibicides* FINLAY, 1939

Genotype, *Vagocibicides maoria* FINLAY

Vagocibicides nipponicus UCHIO, sp. nov.

Plate 3, Figures 8 a, b.

Description:—Test plano-convex, elongate, dorsal side flattened or slightly concave, early stages similar to *Cibicides*, followed by several biserial chambers and finally uniserial, uncoiling, expanding somewhat as chembers are added; sutures depressed ventrally and limbate dorsally; wall calcareous, rather coarsely perforate, dorsal side somewhat transparent; aperture in the early stages as in *Cibicides*, in adult rounded with a short neck and a lip along outer growing edge of the last chamber.

Holotype:—Reg. No. CF 3015, in tufaceous coarse sandstone at Loc. 11, type-locality of Tomiya tufaceous sandstone (Tomiya, Takeoka-mura, Kimitsu-gun, Chiba-ken), 1000 m. SWW of Kazusaminata Railway-station on West Bōsō Line (Upper part of Tomiya tufaceous sandstone, upper Pliocene). Length ca. 0.62 mm, width ca. 0.21 mm.

Occurrence and geological age:—Rare at type-locality above mentioned, upper Pliocene. *Cassidulina kazusaensis* ASANO & NAKAMURA is the dominant species associated with *Vagocibicides nipponicus* UCHIO.

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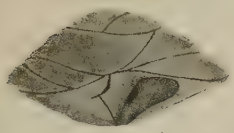
3 T. UCHIO; 1951, "Foraminiferal study of Tertiary Formations near Ōtaki Gas Field, Chiba Prefectures", *Jour. Geol. Soc. Japan. Vol. 57, No. 664.* (in Japanese).

Expanation of Plate

Figs. 1a–c. *Pseudeeponides japonicus* UCHIO (Holotype) × 86.
Figs. 2a, b. *Cassidulina asanoi* UCHIO (Holotype) × 98.
Figs. 3a, b. *Cassidulino tomiyaensis* UCHIO, sp. nov. (Holotype) × 62.
Figs. 4a, b. *Cassidulina nakamurai* UCHIO (Holotype) × 89.
Figs. 5a, b. *Heronallenia otukai* UCHIO, sp. nov. (Holotype) × 82.
Figs. 6a–c. *Loxostomum koikei* UCHIO, sp. nov. (Holotype) × 45.
Figs. 7a, b. *Bolivina otuka* UCHIO, sp. nov. (Holotype) × 65.
Figs. 8a, b. *Vagocibicides nipponicus* UCHIO, sp. nov. (Holotype) × 59.
Figs. 9a, b. *Pyrgo depressa* var. *tomiyaensis* UCHIO, var. nov. (Holotype) × 48.
Figs. 10a, b. *Entosolenia ozawai* UCHIO, sp. nov. (Holotype) × 164.
Figs. 11a, b. *Entosolenia circulo-costa* var. *carinata* UCHIO, var. nov. (Holotype) × 125.
Figs. 12a, b. *Entosolenia marginata* var. *semistriata* UCHIO, var. nov. (Holotype) × 148.
Figs. 13a, b. *Entosolenia marginata* var. *cushmani* UCHIO, var. nov. (Holotype) × 91.
Figs. 14a, b. *Entosolenia marginata* var. *angulata* UCHIO, var. nov. (Holotype) × 84.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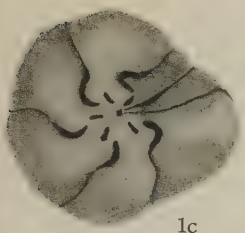
1b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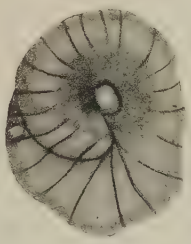
2a


2b


3a


3b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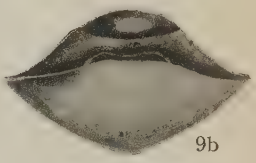
5b


4a


4b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6c


7b


8b


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6b


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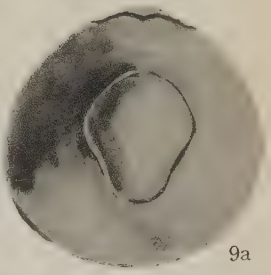
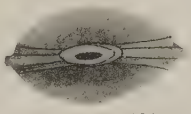

9a


10a


11a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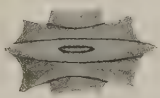
13b


14b


10b


11b


12a


13a


14a

Trans. Proc. Palaeont. Soc. Japan N.S., No. 2 pp. 43—48, 2 text-figs. June. 1951.

198. NOTES ON THE *ENTOMONOTIS*-BEARING TRIASSIC FORMATION AT IWAI NEAR ITSUKAICHI, TOKYO PREFECTURE WITH A DESCRIPTION OF A NEW *ENTOMONOTIS*.*)

by

KOICHIRO ICHIKAWA

Osaka City University

東京都五日市近傍岩井における含 *Entomonotis* 層について，附 *Entomonotis* 一新種の記載：岩井の含 *Entomonotis* 層の産狀を報告し，北上山地の同一年代の皿貝層群における本屬の産狀との比較を行つた。*Entomonotis* は前者では後者の場合のように化石帶をなしては産しない。すなわち，兩地域の堆積環境が相違することを示している。又，*Entomonotis* 各種の現象面的な産出順序にも相違が認められるが，しかし，大觀すれば，その變遷の一般傾向は同一であることを指摘した。終に，本層産の一新種 *Entomonotis iwaiensis* の記載を行つた。 市川浩一郎

During the study on the Late Triassic Saragai group in the Kitakami Mountainland, the writer found the interesting stratigraphical succession of various species of *Entomonotis* (ICHIKAWA 1950b). In order to ascertain whether the succession is the local one confined to the Kitakami Mountainland or the more extensive one, the writer took up the *Entomonotis*-bearing formation at Iwai for study, which is located nearest to the former. The result is presented in this paper together with the description of a new species of *Entomonotis*.

Before proceeding further, the writer expresses his sincere thanks to Prof. T. KOBAYASHI for his encouragement in various ways; he is also very grateful to Mr. A. KUDO for collaborating the general field survey of the Itsukaichi region.

1. Geological Notes

Since "*Pseudomonotis*" was reported from Iwai by FUJIMOTO (1926), several Triassic fossil localities of different ages have been discovered within the distance of several tens of meters from that locality, i. e., marl bearing black shale formation[1] with Early Triassic *Ophiceras* (FUJIMOTO, 1926; SHIMIZU, 1932), limestone bearing sandstone formation[2] with Brachiopods and Pelecypods (CHOH, 1939), Late Triassic (Sakawan) (ICHIKAWA, 1950a) fine sandstone member including *Halobia molukkana* WANNER and *Trigonucula* cfr. *sakawana* ICHIKAWA etc. and white sandstone with *Myophoria* (KUDO, 1946; ICHIKAWA and KUDO, 1951). The complicated geologic structure has recently been investigated by KUDO and the writer, and the present

* Read: Sept. 20, 1950; received: Nov. 10, 1950. This is a result of the study made by the research grant from the Education Department.

1) named as Iwai formation by ICHIKAWA and KUDO (1951).

2) named as Arai formation by ICHIKAWA and KUDO (1951).

survey is summarized in the "Triassic System of Japan" (1951).

As shown in the geological map, *Entomonotis*-bearing formation forms a narrow "Schuppe", thrusting over the *Ophiceras*-bearing formation (Iwai formation) to the west and thrust by the fusulinids bearing Palaeozoic chert and limestone formation from the eastside, and itself forms an anticline with the general axis of N 10°–60° W, 35°–70° W or E. In the western wing there lies the limestone bearing sandstone formation with Brachiopods and Pelecypods (Arai formation) to the west of the present formation in the same trend, but they may be separated from each other by a fault. At any rate, the exact stratigraphical relation between the two is unknown.

The *Entomonotis*-bearing formation is composed of dark greenish fine sandstone, micaceous sandstone and black shale, and at least 30 m thick along the M-valley (see geological map), where it is best exposed.

2. Mode of occurrence of *Entomonotis*

Loc. 50 KI-6 is the famous fossil locality along the valley and belongs to the western wing of the anticline. Here the following succession of each species of *Entomonotis* can be observed in discending order.

		thickness in meter
loc. 6e,	z, p inclusive (boulder)	6
loc. 6d,	d 50, o 25, a 25	—
		6.5
loc. 6c,	d 74, o 26	—
		3.0
loc. 6b,	d 5, o 20, e 30, a 35, p 10	1.8
		0.8
loc. 6b,	d 14, o 29, e 29, a 28	0.5
		0.8
loc. 6a,	i 100	2.2

Notes:—Abbreviation; z- *Entomonotis zabaikalica*, p- *E. pachypleura*, o- *E. ochotica*, d- *E. ochotica* var. *densistriata*, e- *E. ochotica* var. *eurachis*, a- *E. ambigua*, i- *E. iwaiensis* (nov.) The figure shows the individual percentage of each species at each locality. The calculation is based upon 150 individuals for loc. 6a–6c where fossils are abundant, and 20 individuals for loc. 6d where they occur in a limited plane of stratification. The optional sampling is more or less restricted in the case of Older Mesozoic megafossils, since only such parts of exposure where fossils are well preserved and easily collectible must be sought for the specific and infraspecific identification, but the writer tried to collect from as many scattered parts as possible within one bed.

Beside this, d 100 is calculated at loc. 11 about ten and several meters below loc. 2a, but it is not yet certain whether loc. 11 lies truely below loc. 2a or not, since dip and strike is not known of the former locality. Fossils are rather rare in other parts of the western wing. In the eastern wing *Entomonotis* is very rare and there is no locality where fossils occur so abundantly as in loc. 6. At loc. 50 KI-10 (a cliff behind a house) to the south near Tenshô-ji, *Entomonotis* occurs abundantly and e 49, p 23, o 20, d 6, a 2 is calculated from 150 individuals.

From these observations following statements are available, namely—

1) At Iwai the member with abundant fossils merges laterally with the member with few fossils and there is no clear fossil zone[3] as seen in the Saragai group. In other words the occurrence belongs to the kind of fossil enclosure (IJIRI and FUJITA, 1949). This must be due to the difference of sedimentary environment

3) The term "fossil zone" is here used as the member or bed (formational unit) characterised by the occurrence of a certain species or a certain assemblage of several species.

between the contemporaneous Saragai group and the present formation.

2) It may be immature to attempt the general consideration on the mutual relation between the fossil occurrence and the sedimentary (and paleoecological) environment, since the mode of lamination and bedding cannot well be observed due to the bad exposure, and the lateral change of strata as well as of fossil occurrence cannot satisfactorily be pursued owing to the complicated geologic structure. But the above cited succession of *Entomonotis* at locs. 6a–e where fossils are found most abundantly within the formation can hardly be overlooked. In the remaining localities, on the contrary, fossils occur neither abundantly nor successively and their stratigraphical occurrences do not essentially disturb the succession at locs. 6a–e. Therefore the general fossil succession within the present formation may approximately be stated in ascending order as follows:

(1) i 100 (represented by loc. 6a), (2) common occurrence of d, o, e, a, (p) (chiefly represented by locs. 6b-6d), (3) appearence of z (represented by loc. 6e). If loc. 11 (d 100) is really located below loc. 6a, the general tendency of specific occurrence is nearly the same as in the Saragai group.[4]

The following three differences can, however, be pointed out, namely—

1) *Entomonotis iwaiensis* which occurs exclusively in loc. 6a, is not met with in the Saragai group.

2) At Iwai *E. pachypleura* appears already in the part where d, o, e, and a occur abundantly, whereas in the Saragai group it does not yet appear in *E. ochotica* zone where d, o, e, and a occur commonly.

3) In the Saragai group *E. pachypleura* zone characterized by the dominance of *pachypleura* and *eurachis* exists between *E. ochotica* zone and *E. zabaikalica* zone. Such a part is not observed at loc. 6.

The writer interpretes these differences as follows:—

(1) *E. iwaiensis* (nov.) is an unique species different from *ochotica* and its allies in some respects as shown later, and probably belongs to other evolutionary series of *Entomonotis* than *ochotica* series (*tenuissima, typica, ochotica* v. *densistriata, ochotica, pachypleura, zabaikalica*) which can be pursued in the Saragai group. This species occurs exclusively in loc. 6a, and not in other localities, and must be an accidental element.

(2) The specific assemblage of *E. pachypleura* zone in the Saragai group is represented at Iwai in loc. 10, although *pachypleura* is not the dominant element here. Its absence in the profile at loc. 6 may be accidental since the typical fossil zone is not developed at Iwai. Earlier appearence of *pachypleura* at Iwai shows that the phenomena of the specific succession in the Saragai group is not always applied directly to other districts.

3. Summary

Finally it may be concluded that the general evolutionary trend of *Entomonotis* appears similar in the Kitakami

4) In the upper formation of the Saragai group following fossil zones are recognized by the writer (1950b) in ascending order—

(1) *E. typica* zone (t- 30~40%, d- 60~70%)
(2) *E. ochotica* v. *densistriata* zone (d- 100%).
(3) *E. ochotica* zone (o- 25~45%, d- 25~35%, a- 20~45%, e- 10~25%).
(4) *E. pachypleura* zone (p- 50~70%, e- 25~45%, o, a, d a little).
(5) *E. zabaikalica* zone (z- 95%, p, e, o, d 5%).

Mountainland and Iwai, although phenomena of specific succession are not quite the same, because of the difference of the sedimentary environment. At Iwai early representatives such as *E. tenuissima* and *E. typica* are not yet found, and further *E. iwaiensis* appears as an exotic member before the stage of common occurrence of d, o, e and a.

4. Description of species

Genus *Entomonotis* MARWICK, 1935

Reference:—*Entomonotis* KOBAYASHI and ICHIKAWA, 1949, p. 248.
Genotype:—*Monotis salinaria* var. *richmondiana* ZITTEL.

Entomonotis iwaiensis ICHIKAWA, new species

Text-figures 1-2.

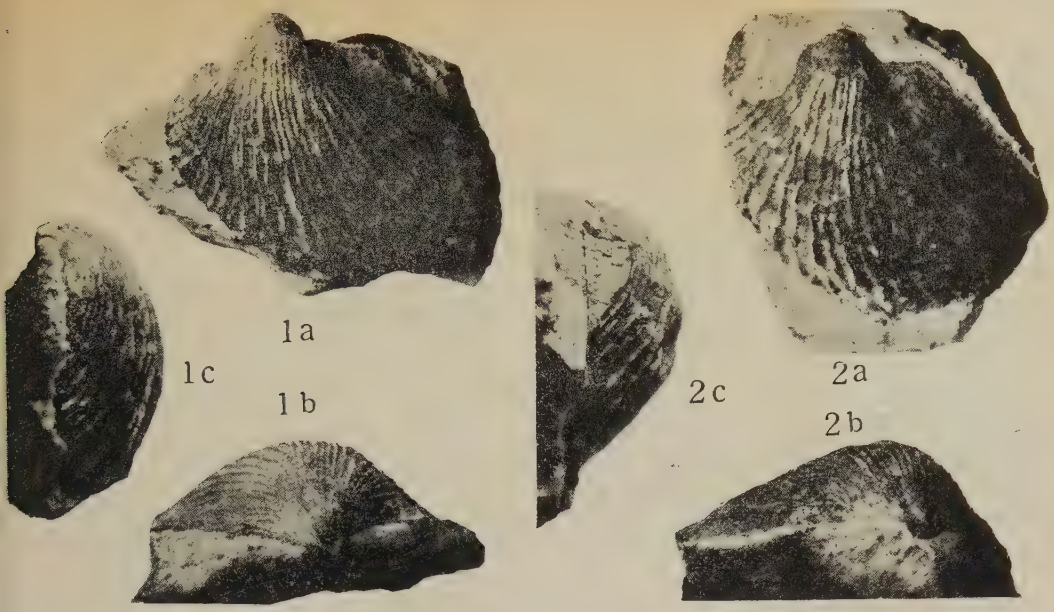
Descrtption: Shell comparatively small for the genus, inequilateral, a little longer than high, postero-ventrally elongated. Left valve rather strongly inflated, the maximum inflation lying at about mid-height; anterior margin rounded up to the dorsal margin, ventral margin broadly arcuate, posterior margin strongly convex, the posterior extremity lying at about umbonal two-thirds of the height; hinge-line straight and short, about half as long as the maximum length; the posterior wing ill-defined and obtusely truncated behind. Umbo of moderate size, lying at about anterior two-fifths of the shell-length, much rising above and overlapping the hinge-line, and strongly incurved. Surface covered with fine, distinct, and comparatively regular ribs which count about 40 in the holotype, 20 mm long, and become finer in the postero-dorsal area; ribs of second order rather rare, initiated near the beak and becoming nearly as strong as the primary in later stage; concentric growth striae rather faint.

Measurement: The holotype (MM 5369), a left valve, is 18.5 mm high, 20 mm long and 6 mm thick, while the paratype left valve (MM 5370) is 20 mm high, 22 mm long and 8 mm thick.

Observation: Judging from many topotypes, the umbo of the holotype is a little more slender than usual and the general outline and convexity is better manifested in the paratype (MM 5370) (Text-figs. 2a-c). The ribs of the latter, however, is indistinct owing to the bad state of preservation. Although several ribs of second order are observed in the holotype, they are generally rare in many other topotype. In some specimens ribs are rather densely set, but in some others they are rather broadly spaced.

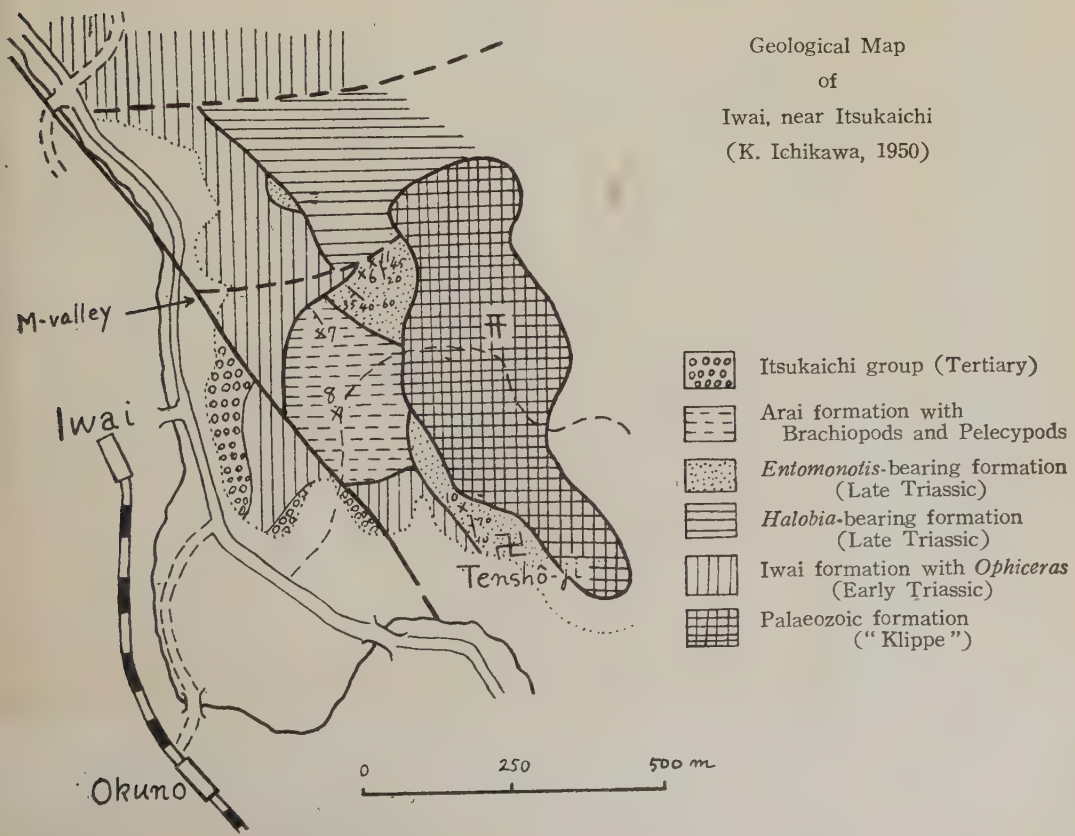
Comparison: *E. iwaiensis* resembles a specimen (MM 5274) from Takenotani of the Sakawa Basin, Shikoku which was once referred to *E. multistriata* KOBAYASHI and ICHIKAWA (1949, p. 255, pl. 9, fig. 14) in the more or less strong inflation, general outline, and general mode of ribbing, but the ribs are more slender and densely set and the ratio of length to the height is a little smaller in the former than in the latter. The present writer now thinks that the "*multistriata*" from Takenotani (op. cit.) is more akin to *E. tenuicostata* var. *mabara* KOBAYASHI and ICHIKAWA (1949, p. 260, pl. 9, fig. 8) from the same locality than to *E. multistriata*,[5] although

5) When the author examined the "*multistriata*" from Takenotani (op. cit.), he was influenced by the fact that it is conspecific with a specimen from Umenokidani which was regarded as the topotype of *multistriata* KOB. and ICHIK. But it may not be so, since it is not certain whether the locality Umenokidani (47TK-25) is exactly represented by one exposure or not.



Entomonotis iwaiensis ICHIKAWA, sp. nov.

Figs. 1a–c. Internal mould of the left valve, the holotype.
a. front view; b. dorsal view; c. anterior view. ×2. (Reg. No. MM 5369).
Figs. 2a–c. Internal mould of the left valve, the paratype.
a. front view; b. dorsal view; c. anterior view. ×2. (Reg. No. MM 5370).
(Both specimens are now kept in the Geological Institute, University of Tokyo.)



Geological Map
of
Iwai, near Itsukaichi
(K. Ichikawa, 1950)

ribs of the second order are regularly inserted and ratio of height to length is smaller in *mabara*.

In outline and especially in the ratio of height to length *E. iwaiensis* is intermediate between the "*multistriata*" from Takenotani and *tenuicostata* var. *mabara*. In some specimens of *iwaiensis* the umbo is prosogyrate as in the "*multistriata*", but in some others it is like that in *mabara*, although the variation may be due to the later deformation. In *tenuicostata* var. *mabara* ribs of the second order are regularly inserted between the primary ones, while ribs of the second order are rare in *iwaiensis* as in *tenuicostata* s. str., but the latter is diferent from the former in the stronger and broader umbo and more densely set ribs.

Formation and *locality*:—*Entomonotis*-bearing formation at loc. 50 KI–6a, along the M-valley at Iwai, near Itsukaichi, Tokyo Prefecture (See geological map.)

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Manuscript completed in September 10th, 1950.

Postscript

S. W. MULLER in 1938 claimed that *Entomonotis* MARWICK must be synonymized with *Monotis* BRONN, because *Monotis salinalia*, the genotype of *Monotis*, has a byssal notch on the right valve like *Entomonotis*. KOBAYASHI and ICHIKAWA (1949), however, hesitated to use *Monotis* instead of *Entomonotis* by the reason that, even if the right valve of *Monotis* has the byssal notch, *Entomonotis* is markedly inequivalve, while *Monotis* is said to be equivalve, of which point MULLER gave no mention in 1938. In reply to the quesion Prof. MULLER kindly communicated with the writer in a letter dated February 12, 1951 that the specimens of *Monotis salinalia*, which he collected in the type locality in the Tyrolian Alps, contained both the equivalve as well as the inequivalve individuals. Although the present writer has not examined the specimens of *Monotis salinalia*, *Monotis* might be used for the group of "*Pseudomonotis*" *ochotica* in future.

Trans. Proc. Palaeont. Soc. Japan N.S. No. 2, pp. 49—56, 2 text-figs. Jan. 1951.

199. ON THE MYOPHORIANS FROM KYOTO PREFECTURE (PROV. Tango).[1]

NOBUKAZU KAMBE

Geological Survey of Japan.

京都府産 *Myophoria* 七種に就て： 1947 年及 1948 年に亘る京都府加佐郡地方の層序學的研究途上志高層群志高層下部（礫岩及砂岩を主とす）から動物化石群を發見した。本動物化石群は志高植物化石群を産する層準より下位から産する。上記動物化石群は 1 cm 內外の非常に小さい二枚貝類で *Myophoria* 6 spp., *Gervillia* spp., *Nucula*? spp. よりなる。特に時代決定の要素となつた *Myophoria* 六種及加佐郡河西村公莊小學校校庭から産した *Myophoria* 一種を記載する。

志高産：

1. *Myophoria tangoensis* KAMBE, new species.
2. *Myophoria shidakensis* KAMBE, new species.
3. *Myophoria* α sp. nov. indet. (aff. *M. laevigata* v. ALBERTI in SCHMIDT)
4. *Myophoria* β sp. nov. indet. by KOBAYASHI and ICHIKAWA, 1949.
5. Cfr. *Myophoria laevigata* (ZIETHEN) var. *elongata* PHIL.
6. Cfr. *Myophoria laevigata* (ZIETHEN) var. *rotunda* PHIL.

公莊産：

7. *Myophoria goldfussi* v. ALBERTI var. *kobayashii* KAMBE, new variety.

志高産 *Myophoria* 六種は總べて E. RÜBENSTRUNK による "Glatten Myophorien Gruppe" に屬し，公莊産 *Myophoria* 一種は "Vielrippigen Myophorien Gruppe" に屬する。

志高層群の時代は *Myophoria* 六種と志高植物化石群によつて Upper Carnic-Noric の 1 時期と結論した。公莊層に就て *Myophoria* 種から判定される時代は Ladinic 乃至 Carnic である。

神戸信和

The coal-bearing formation at Shidaka, 6 km. west of Maizuru, which OGAWA denominated "Shidaka series", in 1897, yields plants. For the age of this flora Upper Jurassic was suggested by TAKAHASHI, 1915, Jurassic by YABE, 1922, Middle Jurassic by OISHI, 1932 and at length Liassic by KOBAYASHI, 1938. Although none of the Dipteridaceae was found, OISHI, 1940, has referred it to his *Dictyophyllum* series. It comprises *Cladophlebis nebbensis* (BRONGN.), *C. denticulata* (BRONGN), *C. haiburnensis* (L. & H.), *C. Raciborskii* forma *integra* O. & T., Cfr. *Zamites megaphyllus* (PHILLIPS), *Taeniopteris stenophylla* KRYSHT., *T. shitakaensis* OISHI, *Czekanowskia* sp., *Podozamites griesbachi* SEWARD and *P. lanceolatus* (L. & H.).

Because the Shidaka area used to belong to the strategic zone, no pricise investigation was done in the stratigraphy of the above mentioned formation. Lately I have carried out its survey and as a result a faunule was discovered near the top of the series, more

1) Received Jan. 20, 1951; read Dec. 2, 1950.

precisely, in the basal part of its top division at Mirokudani of Shidaka, Okadashimo-village, Kasa-gun, Kyoto Prefecture, as the geology of the area had already been reported in my former paper. In this collection 6 species of *Myophoria*, beside indeterminable *Gervillia*, *Nucula* (?) and a few others, were distinguished as follows:

1. *Myophoria tangoensis* KAMBE, new species
2. *Myophoria shidakensis* KAMBE, new species
3. *Myophoria* α sp. nov. indet. (aff. *M. laevigata* v. ALBERTI in SCHMIDT)
4. *Myophoria* β sp. nov. indet. by KOBAYASHI and ICHIKAWA, 1949
5. Cfr. *Myophoria laevigata* (ZIETHEN) var. *elongata* PHIL.
6. Cfr. *Myophoria laevigata* (ZIETHEN) var. *rotunda* PHIL.

The profusion of Myophorians evidently indicates that the faunule must be Triassic, instead of Jurassic. All of these species, however, belong to the *laevigata*-group which is widely ranged through the Triassic. *M. laevigata* is distributed from Skytic to Noric and its varieties, *rotunda* and *elongata* in Ladinic and from Skytic to Anisic respectively. *M. shidakensis* is similar to *M. laevigata* and so *M. tangoensis* to Upper Triassic (?) *M. timorensis*. *Myophoria* β sp. nov. indet. is apparently allied to the one from the *Myoconcha* sandstone in the Sakawa basin in Kochi Prefecture (Prov. Tosa) which is late Carnic, if not early Noric. Except the last one there is none exactly identifiable with any species of known age.

For the chronological consideration, however, it is noteworthy that the Lower Carnic Nabae group in the same region is strongly disturbed together with the older formations (NAKAZAWA and OKADA, 1949), while the Shidaka which reveals the Molasse type of sedimentation, lies unconformably on the already contorted Palaeozoic formation. Therefore the faunule in question must be not older than Middle Carnic. But at the same time it can be mentioned from the aspect of the Myophorians that the age of the faunule must be not younger than Noric, the conclusion being upheld by the above listed flora, if one notices the fact that the Rhaeto-Liassic type of flora appears in Japan already in the Carnic period (KOBAYASHI, 1939).

On this occasion *Myophoria goldfussi* v. ALBERTI var. *kobayashii* KAMBE from the Guzyo formation at Guzyo, Kawanishi-village, Kasa-gun is described. Because the geologic structure there is complicate, its stratigraphic position must be older than the Nabae (NAKAZAWA, 1950). Because the known range of *M. goldfussi* is from Ladinic to Noric, the age of the Guzyo fossil bed may be either Carnic or Ladinic.

Here I wish to express my sincere thanks to Prof. T. KOBAYASHI of the University of Tokyo for his suggestion and guidance and also to Mr. K. ICHIKAWA for the assistance in this palaeontological study.

Family Trigoniidae LAMARK

Genus *Myophoria* BRONN, 1827.

The genus has already been studied by LYCETT (1879), WOHRMANN (1893), KOKEN (1896), WAAGEN (1907), RÜBENSTRUNK (1909), DIENER (1925), SCHMIDT (1928), FRANK (1929) CRICKMAY (1932), LEBKÜCHNER (1932) and many others and it is generally considered to be the linking genus between *Schizodus* and *Trigonia*. RÜBENSTRUNK classified it into five groups, namely Glatten Myophorien, Einrippigen M., Zweirippigen M., Vielrippigen M., Konzentrisch skulpturierten M.

In Japan Myophorians are reported to

occur in the Permian of Kinsyozan at Akasaka, Gifu Pref. (Prov. Mino.) by HAYASAKA (1925), Permian Kohama limestone at Kohama, Monohu-gun in the Kitakami mountainland by INAI and TAKAHASHI (1940), early Triassic formation at Kurotaki, in Kochi Pref. by MATSUSHITA (1926), early Triassic Hiraiso formation at Hiraiso sea-shore, Motoyoshi-gun in the same mountainland by MABUTI, Upper Triassic Kochigatani series of the Sakawa basin in Shikoku by KOBAYASHI and ICHIKAWA (1949), Triassic (Ladinic or Carnic) Guzyo formation at Guzyo, in Kyoto Pref. (Prov. Tango) and the Triassic (Noric or Upper Carnic) Shidaka formation at Shidaka in the same province both by myself (1950), but only a part of them are so far described. The Shidaka specimens are not well preserved, but a few of them show the typical dentation of *Myophoria*.

Putting aside the Permian ones of which the generic reference is not warranted, all of them are Glatten Myophorien except one from Guzyo which belongs to the group of Vielrippigen Myophorien. Such a display of Glatten Myophorien of *laevigata* group in the Upper Triassic of Japan is certainly remarkable.

1. *Myophoria tangoensis* KAMBE, new species.

Plate 4, Figures 1 a-b.

Description:—Shell small, inequilateral, subtrigonal, broader than high and convex; ventral margin broadly arcuate; postero-ventral margin somewhat rounded; antero-ventral margin subangular; posterior submarginal area broad and bordered anteriorly by a blunt costa; umbo located at the point four-ninths of the shell-length from the anterior extremity, prominent and provided with a prominent umbonal ridge; area with weak radial striation; surface smooth.

Figure 1 shows the hinge. The obliquely lined parts are projected in the internal mould of the right valve and accordingly correspond to 2b and 2a of the left valve and the sockets to 3b+1 and 1 of the right valve. For the terminology of the dentation, see LEBKÜCHNER, 1932, p. 24, fig. 18.

An internal mould and an external cast of a right valve is 6mm. high and 9mm. long; its apical angle 150° and the angle exclusive of the area 120°.

Figure 1. Sketch showing the hinge of *Myophoria tangoensis*.

Comparison:—This species is allied to (?) *M. timorensis* KRUMBECK (1924, p. 238, pl. 18, figs. 17–20) from the upper Triassic of Timor, but more or less different in the position of the umbo and costa, the umbo being more projected in the former than in the latter and the costa less rounded in the former than in the latter.

Occurrence:—Miroku-dani.

2. *Myophoria shidakensis* KAMBE, new species.

Pl. 4, Figs. 2 a-b.

Description:—Shell small, subtrigonal, inequilateral, moderately convex; postero-ventral margin abruptly rounded; ventral margin arcuate; anterior margin nearly straight; posterior submarginal area obtusely triangular and bordered anteriorly by a prominent and sub-

angulate costa; umbo located at about anterior one-third of the shell-length, prominent and prosogyr, with an umbonal ridge in front of it; surface smooth, with two or three concentric lines of growth near the ventral margin; posterior submarginal area smooth.

A left valve is 9 mm. high and 13 mm. long; its apical angle 100° and the angle exclusive of the area 75°; dentition not well known.

Comparison:—This species is closely allied to *M. laevigata* in SCHMIDT (1928, p. 183, fig. 421). The costa is, however, more broadly roof-shaped in the former. It also resembles (?) *M. timorensis* KRUMBECK (1924, p. 238, pl. 18, figs. 17–20), but differs from this Timor form in the position of the umbo and the mode of the costa.

Occurrence:—Same as the preceding.

3. *Myophoria α* sp. nov. indet.

pl. 4, Fig. 3.

Shell small, somewhat inequilateral, trigonal, as high as long, inflated; posterior margin arcuate; postero-ventral margin imperfectly preserved but appears subangular; anterior margin nearly straight; ventral margin partly broken; submarginal area vertical to the plane of junction between the two valves and bordered anteriorly by a prominent angular costa; umbo prominent and located a little anterior to the mid-length; area probably provided with a radial rib; umbonal ridge not observed; surface probably smooth; dentition seen as illustrated in figure 2 of the internal mould of the left valve. The obliquely lined parts are the projections, corresponding to 1 and 3b+1 of the right valve and the sockets to 2b and the lateral teeth of the left valve.

An internal mould of a left valve is 13 mm. as long, as high; its apical angle 90° and the angle exclusive of the area 80°.

Figure 2. Sketch showing the hinge of *Myophoria α* sp. nov. indet.

Comarison:—This is more or less allied to *M. laevigata* v. ALBERTI in SCHMIDT (1928, p. 183, fig. 421), but differs from the latter species in the aspects of the costa, and the submarginal area. The costa is arcuate and acutely angulated and the area provided with radial ribs in the latter species.

Occurrence:—Same as the preceding.

4. *Myophoria β* sp. nov. indet. by KOBAYASHI and ICHIKAWA, 1949.

Pl. 4. Figs. 4a-b.

1949. *Myophoria* sp. nov. indet. KOBAYASHI & ICHIKAWA, *Japan. Jour. Geol. Geogr. vol. 21, no. 1-4*, p. 183, pl. VI, fig. 5.

The Shidaka specimens coincides with *Myophoria* sp. nov. indet. from the *Myoconcha* sandstone at Umenokidani in the Sakawa basin in most accounts, notably in the costation and the position of umbo. They are roundly subtrigonal, very inequilateral, fairly well inflatened; posterior submarginal area obtusely triangular and bordered anteriorly by a blunt costa; umbo located at the anterior two-fifths of the shell-length, prominent, pointed forward and delimited by a subvertical umbonal ridge anteriorly; anterior margin short and straight;

test smooth. The ventral margin and dentition cannot be seen. As the dimensions are given below, the Shidaka specimens are smaller than those from Sakawa. One right valve and two left valves at hand.

Comparison:—This can be distinguished from *Myophoria* α sp. nov. indet. by the situation of the submarginal area, position of the umbo and the costation and from *M. shidakensis* by the outline and costation.

	right valve (I)	left valve (II)	left valve (III)
height	11mm.	7mm.	10mm.
length	12mm.	8mm.	11mm.
apical angle	80°	100°	100°
apical angle exclusive of the area	60°	70°	70°

Occurrence:—Same as the preceding.

5. Cfr. *Myophoria laevigata* (ZIETHEN) var. *elongata* PHIL.

Pl. 4, Figs. 5 a-b.

1928. Cfr. *Myophoria laevigata* var. *elongata*, SCHMIDT, Die Lebewelt Unserer Trias, p. 185, fig. 425.

Shell small, elongated subtrigonal, broader than high, very inequilateral and moderately convex; posterior margin arcuate; postero-ventral and anterior margins not well seen; posterior submarginal area large, elongate suboval and bordered anteriorly by a prominent angular costa; umbo lying at about the anterior one-third of the shell-length, prominent and provided with an umbonal ridge in front of it; area having a weak radial rib in the middle part; surface smooth; dentition not clearly observed. An internal mould of a left valve and an internal mould and external cast of a right valve give the following dimensions:

	right valve (V)	left valve (VI)
height	5mm.	9mm.
length	7mm.	11mm.
apical angle	140°	140°
apical angle exclusive of the area	110°	110°

Comparison:—Its close ally is *M. laevigata* var. *elongata* PHIL. in SCHMIDT (1928), but owing to the incomplete state of preservation any exact identification is not admitted.

Occurrence:—Same as the preceding.

6. Cfr. *Myophoria laevigata* (ZIETHEN) var. *rotunda* PHIL.

Pl. 4, Figs. 6 a-b.

1928. Cfr. *Myophoria laevigata* var. *rotunda*, SCHMIDT, Die Lebewelt Unserer Trias p. 183, fig. 423.

Shell small, broadly ovate, nearly equilateral and somewhat inflated; posterior, anterior and ventral margins well rounded without any interruption among them; posterior submarginal area subtrigonal, depressed and bordered anteriorly by a prominent subangular costa; umbo lying at the anterior three-sevenths of the shell-length, prominent, with a somewhat oblique umbonal ridge in front of it; surface smooth; area of the left valve apparently possesses a

radial rib; dentition not clearly observed.

A right and left valve, each represented by an internal mould and external cast, are in the collection.

	right valve (VIII)	left valve (VII)
height	6mm.	8mm.?
length	7mm.	9mm.?
apical angle	120°	120°
apical angle exclusive of the area	90°	90°

Comparison:—This species is similar to *M. laevigata* var. *rotunda* PHIL. in SCHMIDT (1928), in the broad area, presence of one radial rib on the area and the prominent costa.

Occurrence:—Same as the preceding.

7. *Myophoria goldfussi* ALB. in BITTNER var. *kobayashii* KAMBE, new variety.

Pl. 4, Figs. 7 a-b.

1895. *Myophoria goldfussi* ALB. in BITTNER. *Abhandl. Geol. R. A. Bd. 18. H. I*, p. 102, pl, 11. figs. 24-27.

Description:—Shell small, roundly subtrigonal, inequilateral; anterior margin shorter than the posterior; ventral margin arcuate, posterior submarginal area obtusely triangular, bordered anteriorly by a prominent costa; umbo located near the anterior extremity, prominent and provided with a broad umbonal ridge in front of it; radial ribs prominent, countable about 14 on the main shell and more prominent near the anterior margin, but become obsolete in approaching to the costa; many striae of growth seen frequently; two or three radial ribs and some growth striae also seen in the area. Tooth of right valve similar to *Myophoria tangoensis*. Many specimens in hand are mostly right valves.

	right valve	right valve	right valve
height	14mm.	10mm.	10mm.
length	17mm.	12mm.	13mm.
apical angle	150°	150°	150°
apical angle exclusive of the area	130°	130°	130°

Comparison:—Although the details of dentition are unknown, it is certain that this form is intimately related to *Myophoria goldfussi* ALB. in BITTNER. It is however, taken for its variety because of the mode of radial ribs which are distinct even in the posterior half in the typical form of that species, but become obscure in this variety.

Occurrence.—Guzyo.

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Explanation of Plate 4

Myophoria tangoensis KAMBE, new species.

Fig. 1a. Internal mould of the cotype; right valve, ×2. Loc. Miroku-dani.

Fig. 1b. External cast of the cotype; right valve, ×2. Loc. Miroku-dani.

Myophoria shidakensis KAMBE, new species.

Fig. 2a. Internal mould of the cotype; left valve, ×1.5. Loc. Miroku-dani.

Fig. 2b. External cast of the cotype; left valve, ×1.5. Loc. Miroku-dani.

Myophoria α sp. nov. indet.

Fig. 3. Internal mould of the left valve, ×1.5. Loc. Miroku-dani.

Myophoria β sp. nov. indet. by KOBAYASHI and ICHIKAWA, 1949.

Fig. 4a. Internal mould of the right valve, ×1.5. Loc. Miroku-dani.

Fig. 4b. External cast of the right valve, ×1.5. Loc. Miroku-dani.

Cfr. *Myophoria laevigata* (ZIETHEN) var. *elongata* PHIL.

Fig. 5a. Inteanal mould of the right valve, ×3. Loc. Miroku-dani.

Fig. 5b. External cast of the right valve, ×2. Loc. Miroku-dani.

Cfr. *Myophoria laevigata* (ZIETHEN) var. *rotunda* PHIL.

Fig. 6a. Internal mould of the right valve, ×3. Loc. Miroku-dani.

Fig. 6b. External cast of the right valve, ×3. Loc. Miroku-dani.

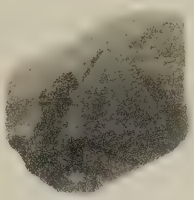
Myophoria goldfussi ALB. in BITTNER var. *kobayashii* KAMBE, new variety.

Fig. 7a. Internal mould of the cotype; right valve, ×1.5. Loc. Guzyo.

Fig. 7b. External cast of the cotype; right valve, ×1.5. Loc Guzyo.

All of these specimens are kept in the Geological Institute, University of Tokyo

1a



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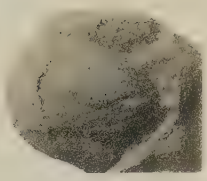

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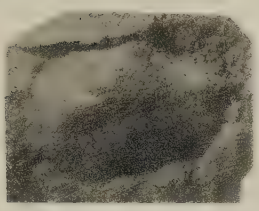

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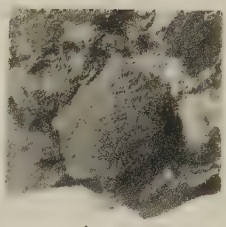

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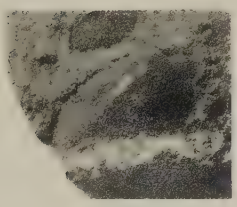

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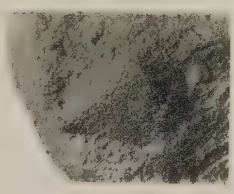

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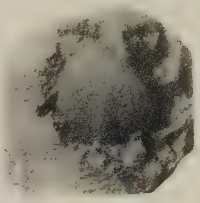

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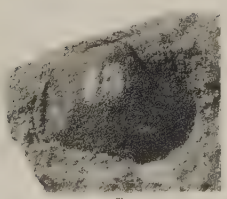

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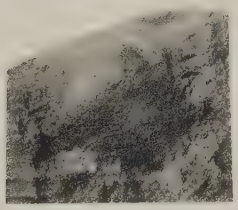

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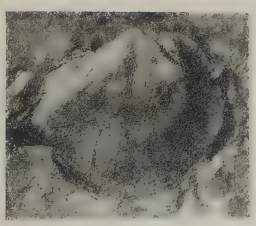

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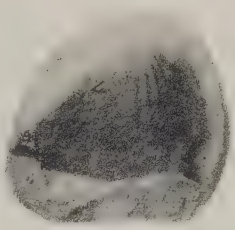

7b

Trans. Proc. Palaeont. Soc. Japan N.S., No. 2. pp. 57—64, 3 text-figs. June. 1951.

200. PLIOCENE PINNIPED REMAINS FROM KANAZAWA, ISHIKAWA PREFECTURE, JAPAN.[1)]

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金澤市大桑層産トド化石について：金澤市東北端御所町南方の大桑層上部より産出したトド化石について記載した。既記載種と比較したが，それらの何れとも同定できなかつた。しかし新種とすることはさしひかえ，假に "*Allodesmus*" sp. と呼んでおく。 柏野義夫

Introduction

The material described herein*, consisting of a right mandible and four detached teeth of Pinnipedia, was collected** from the upper part of the Onma formation (Pliocene) at a road-cutting south of Gosyo village, north-eastern end of Kanazawa City, Ishikawa Prefecture, Japan. (Lat. 36° 34′ 40″ N.; Long. 138° 41′ 10″ E.) (Figure A.)

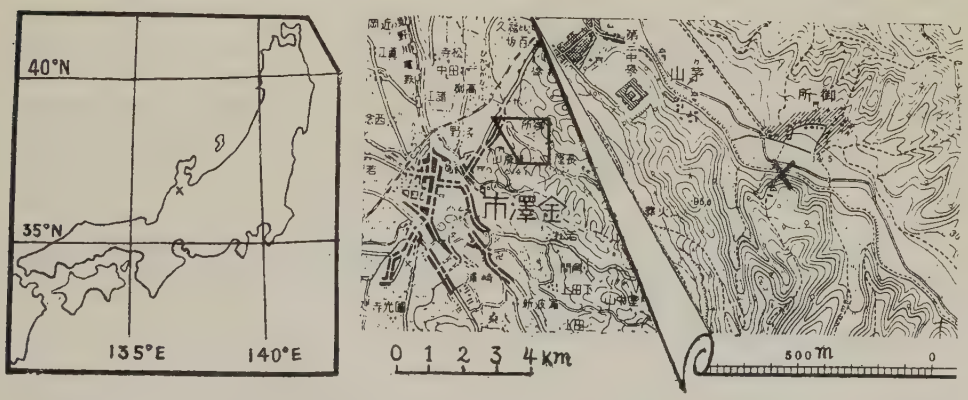

Figure A. Maps showing the locality.

The locality where the present material occurred is composed of homogeneous silty fine-grained sandstone of bluish colour. Together with the present material there were found many imperfect remains of molluscs as *Acila*, *Pecten*, *Venericardia*, *Myodora*, *Cardium*, *Diplodonta*, etc. It seems probable that the remains of Pinnipedia and molluscs were gathered up by waves and currents, and entombed in the shallow sea bottom to form a fossil bank.

1) Read March 17, 1951; received April 12, 1951.

* Now deposited in the Geological Institute, College of Science, Kanazawa University, Kanazawa, Japan.

** In October, 1946, collected by the writer and the Third-year students of the Biological Department, Kanazawa Higher Normal School.

In Japan the fossil remains of Tertiary Pinnipedia have hitherto been reported from the Upper Pliocene (?) of Kazusa (MATSUMOTO, H. 1925, 1926) and from the Middle Miocene (?) of Shinano (NAGAO, T. 1941).* Thus the new occurrence seems to be of interest both from geological and palaeontological standpoints.

DESCRIPTION

(1) *Right Mandible.* (Figures C, 1, 3, 4.)

The horizontal ramus of the mandible is almost complete, with the ascending ramus broken off. The mandible is strongly inflated and stout anteriorly, with its maximum depth behind the canine; posteriorly it gradually becomes low, being lowest slightly in front of the plane of coronoid. The horizontal ramus is thickest in the anterior portion, and becomes gradually thinner posteriorly.

The upper border of the horizontal ramus is almost straight, the lower strongly curved down in the anterior portion. Its outer surface is strongly convex in its anterior portion, being much flattened in the middle. Inner surface is rather flattened compared with the outer.

There are six distinct mental foramina on the outer surface, nearly spherical or ellipsoidal in form, with the diameter varying from about 3 to 9 mm., the depth from 2 to 4 mm. or more.

The symphysis is roundly triangular in outline, very stout and heavy, and not ankylosed. The symphysial surface is considerably corrugated and with several irregular grooves in the upper portion, but rather smooth in the lower half as far as observed.

Some measurements of the right mandible are as follows:

Length of the preserved portion.	240 mm.
Distance between the posterior margin of the last molariform and the anterior margin of the canine.	124 mm.
Distance between the anterior margin of the first molariform and the posterior margin of the last molariform.	84 mm.
Maximum depth of the horizontal ramus below the second molariform.	77 mm.
Maximum thickness of the horizontal ramus	26 mm.
Maximum length of the symphsis.	86 mm.

(2) *Dentition.* (Figures C, 1; 2a, b, c.)

The present right mandible has a large canine and the second molariform tooth attached, other teeth missing.

The dentition of the present species as far as observed is as follows**:

I_2, I_3; $C_{\overline{1}}$; $LT_{\overline{1}}$, $LT_{\overline{2}}$, $LT_{\overline{3}}$, $LT_{\overline{4}}$, $LT_{\overline{5}}$.

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* Aside from several specimens which have been reported by Mr. N. NAORA. (NAORA, N. 1944).

** All molariform teeth are uniformly designated as "LT", because there are no criterion to distinguish the molar from the premolar.

Dimensions of alveoli and intervals in between are given as follows:

	I_2	I_3	C_1	LT_1	LT_2	LT_3	LT_4	LT_5
Antero-posterior diameter of alveolus in upper margin of the mandible. (mm.)	9	12	40	14	14	18	19	18
Transversal diameter of alveolus perpendicular to the above. (mm.)	5	9	29	12	10	12	10	10
Maximum depth of alveolus (estimated). (mm.)	13	20	?	20	?	29	28	22
Minimum interval between alveoli. (mm.)	3	0	7	2	3	0	0	

Incisors. Two incisors are missing, alveoli only being preserved. On examining the alveoli, the outer incisor (I_3) is large in size and subcircular in cross-section, situated very closely to the canine. The inner incisor (I_2) is much smaller in size, about one-half of the outer one, situated a little back of the latter, sub-elliptical in cross-section with the longest diameter parallel to the symphysial surface. The alveolus of the inner incisor is strongly curved backward, which indicates that the inner incisor is directed forward at an angle of about 45 degrees.

Canine. Canine is situated very close to the outer surface of the horizontal ramus, large and bluntly conical, directed considerably outward, curved backward toward the tip which is broken off. The cross-section at the base of the crown is sub-elliptical in outline, elongated antero-posteriorly; it is slightly smaller than the cross-section at the alveolus. Canine is brownish in colour; its surface is provided with numerous, crowded longitudinal wrinkles or ribs, directed from the apex to the base. The root is long, extending backward, and is penetrated by the pulp hole which is circular in cross-section. Dimensions are:

Height of crown as preserved ..... 45 mm.
Height of crown above ramus (estimated) ..... 55 mm.
Antero-posterior diameter of basal section ..... 36 mm.
Transversal diameter perpendicular to the above..... 31 mm.

Molariform series. Having only one molariform tooth *in situ*, it is very difficult to give a full description of this series. There is scarcely a progressive increase in size from the first to the fifth; but the first and the second are sub-circular in cross-section and nearly equal in size, and more or less smaller than the rest (the third to the fifth), which are sub-elliptical in cross-section and nearly equal in size.

The first and probably the second are one-rooted and not grooved, alveolus of the former being strongly curved backward at an angle of 45 degrees or less to the ramus. The third as indicated by the alveolus is very faintly grooved

only on the outer side and is nearly straight and almost vertical to the ramus. The alveolus of the fourth is strongly grooved outside and faintly inside, and becomes two-rooted at the apex of root. The fifth distinctly bifurcates in the upper portion of the root, the anterior branch being slightly smaller than the posterior in cross-section; both are nearly straight and vertical.

The crown of the second molariform tooth is low-conical, bluntly pointed at the tip, sub-elliptical in cross-section, slightly elongated antero-posteriorly. One anterior and one indistinct posterior accessory cusps are developed, and the latter is larger in diameter than the former. The second molariform tooth has also a considerably well defined cingulum, especially in the inner side, on which a well defined peripheral cusp occurs. (Figures C, 2a, b, c.) Measurements of the second molariform are as follows:

Antero-posterior diameter of the tooth	13 mm.
Greatest height of the crown	9 mm.
Greatest width of tooth at cingulum	10 mm.

(3) *Detached Teeth.* (Figures B, 1–4.)

There are four detached teeth of molariform series which were obtained together with the mandible described above. These seem to belong to the same species and in all probability to the same individual as the mandible. Here, therefore, some of their morphological features will be described, without assigning their original positions, and simply numbering from 1 to 4.

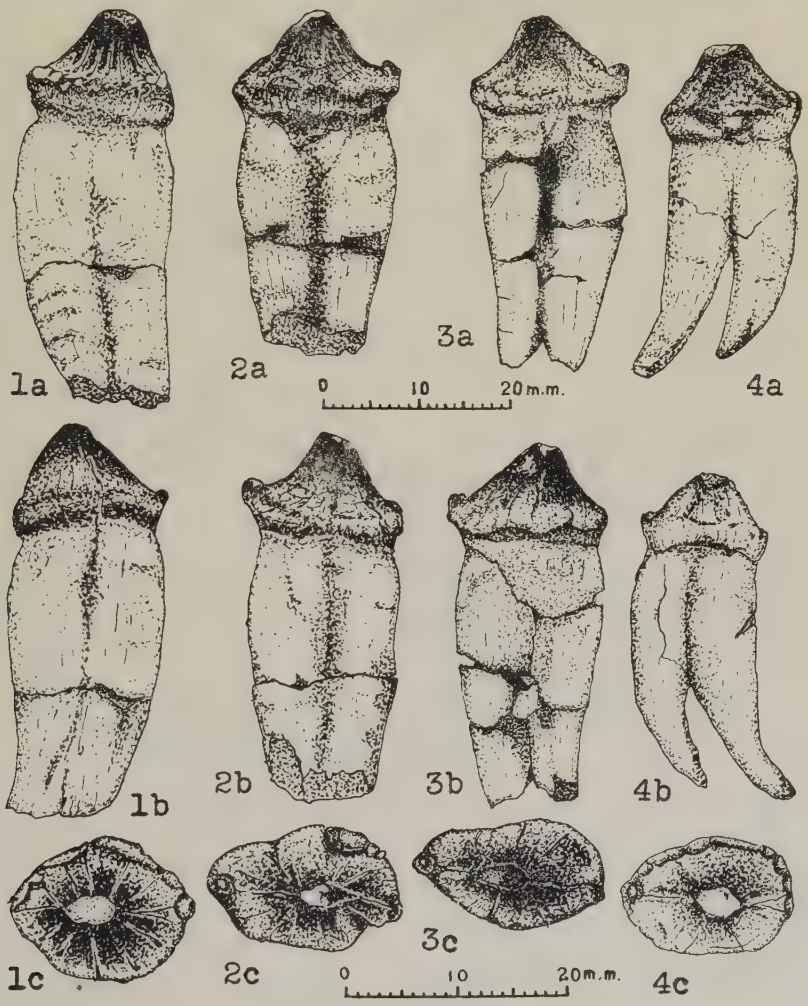
No. 1 (Figures B, 1a, 1b, 1c.) has a considerably high, conical crown, bluntly pointed at the tip, with one (posterior?) cusp, and with sharp cutting edges. There develops a well defined cingulum, with poorly defined peripheral cusps in the inner side. The root has faint groove in the inner side, whereas the outer groove is developed in the lower half only; the root is curved

Dimensions of four molariform teeth are tabulated as below:

	No. 1	No. 2	No. 3	No. 4
Antero-posterior diameter in neck. (mm.)	13	14	14.5	13
Transversal diameter in neck. (mm.)	10	9	8.5	9
Antero-posterior length of crown. (mm.)	15.5	17	17	14.5
Width of tooth at cingulum. (mm.)	12	11	10	10
Greatest height of crown. (mm.)	13.5	13	12	11
Length of root. (mm.)	29+	27+	29+	29+

inward and slightly forward.

No. 2 (Figures B, 2a, 2b, 2c.). Cross-section in neck is sub-elliptical, with a longer antero-posterior diameter. The crown is moderately high, conical, and bluntly pointed at the tip, with sharp cutting edges and with one well defined (posterior?) accesory cusp. The cingulum is more or less distinct, especially in the inner side, where an irregular cusp occurs. The root is nearly straight, with faint median depressions

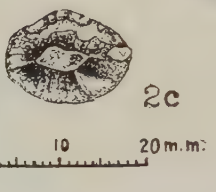


Figures B, 1—4. Detached molariform teeth No. 1-No. 4.

1a. Inner view of No. 1; 1b. Outer view of No. 1;
1c. Upper view of No. 1; 2a. Inner view of No. 2;
2b. Outer view of No. 2; 2c. Upper view of No. 2;
3a. Inner view of No. 3; 3b. Outer view of No. 3;
3c. Upper view of No. 3; 4a. Inner view of No. 4;
4b. Outer view of No. 4; 4c. Upper view of No. 4.


0 50 100 m.m.
1


2a
2b
0 10 20 m.m.


2c
0 10 20 m.m.

3


0 50 100 m.m.
4

both on the outer and the inner sides.

No. 3. (Figures B, 3a, 3b, 3c.) is subelliptical in neck section, its longer diameter being antero-posterior. The crown is conical, with sharp cutting edges and one (posterior?) well defined accessory cusp. Cingulum is poorly developed, and without any distinct peripheral cusp. The root is more or less strongly grooved in the inner side, bifurcated at the apex of root, slightly curved inward and forward.

No. 4 (Figures B, 4a, 4b, 4c.) The crown is bluntly conical, moderately high, with sharp cutting edges and with one (posterior?) accessory cusp. Cingulum is well defined especially in the inner side, where there is a poorly defined peripheral cusp. The root is strongly grooved and distinctly bifurcated at a halfway toward the point, curving strongly inward and forward.

Remarks

The species under consideration evidently belongs to Otariidae, and is especially closely related to the genus *Eumetopias*. As far as the fossil species are concerned, the more closely related to the present species are as follows:

Allodesmus kernensis Kellogg from the Lower Miocene Temblor beds of the Kern River region, Kern County, California. (Kellogg, R. 1922); *Eumetopias watasei* Matsumoto from the "Sanuki Formation of the Narita Series" (Upper Pliocene?) at Umegase, Chiba Prefecture, Japan. (Matsumoto, H. 1925, 1926); *Eumetopias sinanoensis* Nagao from the Miocene (?) Bessyo beds in Gozyo-mura, Higashi-Chikuma-gun, Nagano Prefecture, Japan. (Nagao, T. 1941).

The American species *Allodesmus kernensis* is represented by an incomplete mandible ramus which lacks the posterior portion. Apparently it shows a close affinity in almost all features to the present species, as far as the preserved portion is concerned. On closer examination, however, the present species is different from *Allodesmus* in the dentition, that is, the present species has five lower molariform teeth, without any trace of the sixth; *Allodesmus* has six molariform teeth, among which the last one (the second lower molar M_2) is "very small, tending to disappear". Moreover, in point of the location and number of the mental foramina they are also distinctly different from each other: *Allodesmus* has as many as ten mental foramina, whereas the present species has six, among which the one below the second premolar is very large in size.

The specimen of *Eumetopias watasei* is represented by the right side of the upper snout anterior to the fourth premolar. Because of the ill preservation of the specimen, comparison with the present species is hardly possible. In this species, the roots of the premolar and the canine are more regularly circular in cross-section, and the snout anterior to the canine seems to be longer than that of the present species.

Eumetopias sinanoensis is represented by the anterior portion of the skull which is "so much deformed that reconstruction is almost impossible". This

Explanation of Figures C, 1—4.

Fig. 1. Upper view of the right mandible.
Fig. 2. The second molariform tooth. 2a. inner view; 2b. outer view; 2c. upper view.
Fig. 3. Outer view of the right mandible.
Fig. 4. Inner view of the right mandible.

species also seems to be closely related to the present species as a whole, but differs from the latter in the following features: the canine is rather small compared with that of the present species; the premolars are more circular than in the present species; and the molariform teeth have "no trace of an anterior or posterior cusp and with a very poorly defined cingulum as far as observed", whereas the present species has the molariform teeth with a distinct cusp and a considerably well defined cingulum.

The differences enumerated above, are likely to be considered sufficient as the reason for separating the present form from any other fossil species hitherto described. The writer, however, without more materials and reference works, can not dare to establish a new genus or species on the present fossil. Thus the writer tentatively designates the present form "*Allodesmus*" sp.

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